Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of claims:

1. (previously amended) A quantum computing structure comprising:

a first bank of a superconducting material having a first crystal orientation;

a mesoscopic island of a superconducting material having a second crystal orientation, wherein at least one of the island and the bank comprises a d-wave superconducting material; and

a clean Josephson junction between the island and the bank.

2. (original) The structure of claim 1, further comprising a single electron transistor connected between the island and ground.

3. (previously amended) The structure of claim 1, wherein the clean Josephson junction comprises a grain boundary between the bank and the island.

4. (original) The structure of claim 1, wherein the island comprises a d-wave superconducting material.

5. (original) The structure of claim 4, wherein the bank comprises a d-wave superconducting material.

6. (original) The structure of claim 1, further comprising:

a second bank of superconducting material having a third crystal orientation; and

a Josephson junction between the first and second banks.

7. (original) The structure of claim 6, further comprising a single electron transistor coupled between the second bank and the island.

8. (currently amended) A quantum register comprising:

a bank of a superconducting material;

a plurality of mesoscopic islands of superconducting material; and

a plurality of clean Josephson junctions, each clean Josephson junction being between the bank and a corresponding one of the islands, wherein at least one of the plurality of mesoscopic islands and the bank comprises a d-wave superconducting material.

9-10. (cancelled)

11. (original) The quantum register of claim 8, further comprising a plurality of single electron transistors, each electron transistor being between ground and a corresponding one of the islands.

12. (original) The quantum register of claim 8, further comprising a first plurality of single electron transistors, each single electron transistor in the first plurality being between islands in a corresponding pair of the islands.

13. (previously amended) The quantum register of claim 12, further comprising a second plurality of single electron transistors, each single electron transistor in the second plurality being between ground and a corresponding one of the plurality of mesoscopic islands.

14. (original) The quantum register of claim 8, further comprising:

a second bank of superconducting material; and

a Josephson junction between the first and second banks.

15. (original) The quantum register of claim 14, further comprising a first plurality of single electron transistors, each single electron transistor being coupled between the second bank and a corresponding one of the islands.

16. (original) The quantum register of claim 15, further comprising a second plurality of single electron transistors, each single electron transistor in the second plurality being between ground and a corresponding one of the islands.

17. (original) The quantum register of claim 15, further comprising a second plurality of a single electron transistors, each single electron transistor in the second plurality being between islands in a corresponding pair of the islands.

18. (previously amended) The quantum register of claim 17, further comprising a third plurality of single electron transistors, each single electron transistor in the third plurality being between ground and a corresponding one of the plurality of mesoscopic islands.

28. (currently amended) A qubit, comprising:

a first bank of a superconducting material having a first crystal orientation;

a mesoscopic island having a second crystal orientation formed adjacent to the first bank; and

a clean Josephson junction formed between the first bank and the mesoscopic island, wherein the first crystal orientation and the second crystal orientation are different wherein at least one of the mesoscopic island and the first bank comprises a d-wave superconducting material.

29. (cancelled)

30. (previously added) The qubit of Claim 28, further including a grounding mechanism coupled between the mesoscopic island and a ground.

31. (previously added) The qubit of Claim 30, wherein the grounding mechanism is a single electron transistor.

32. (previously added) The qubit of Claim 30, wherein the grounding mechanism is a parity key.

33. (previously added) The qubit of Claim 28, wherein the clean Josephson junction includes a grain boundary between the island and the first bank.

34. (previously added) The qubit of Claim 28, wherein the clean Josephson junction includes a normal metal.

35. (previously added) The qubit of Claim 28, further comprising:

a second bank of superconducting material having a third crystal orientation; and

a Josephson junction formed between the first bank and the second bank.

36. (previously added) The qubit of Claim 35, further comprising:

a coupling mechanism coupled between the mesoscopic island and the second bank.

37. (previously added) The qubit of Claim 36, wherein the coupling mechanism includes a single electron transistor.

38. (previously added) The qubit of Claim 36, wherein the coupling mechanism includes a parity key.

39. (currently amended) A quantum register, comprising:

a first bank of superconducting material;

at least one mesoscopic island of a superconducting material; and

at least one clean Josephson junction, each clean Josephson junction in said at least one clean Josephson junction formed between a mesoscopic island in the at least one mesoscopic island and the first bank, wherein at least one of the at least one mesoscopic island and the first bank comprises a d-wave superconducting material.

40-41. (cancelled)

42. (previously added) The quantum register of Claim 39, further including at least one first coupling mechanism, each of the at least one first coupling mechanisms coupling a corresponding one of the at least one mesoscopic islands to ground.

43. (currently amended) The quantum register of Claim 42, wherein ~~at~~ said at least one ~~of the~~ first coupling mechanism ~~mechanisms~~ includes a single electron transistor.

44. (currently amended) The quantum register of Claim 42, wherein ~~at~~ said at least one ~~of the~~ first coupling mechanism ~~mechanisms~~ includes a parity key.

45. (currently amended) The quantum register of Claim 39, wherein said at least one mesoscopic island includes a ~~at least one~~ pair of mesoscopic islands that are coupled to each other by a second coupling mechanism.

46. (previously added) The quantum register of Claim 45, wherein the second coupling mechanism includes a single electron transistor.

47. (previously added) The quantum register of Claim 45, wherein the second coupling mechanism includes a parity key.

48. (previously added) The quantum register of Claim 39, further including:

a second bank of superconducting material; and

a Josephson junction formed between the second bank and the first bank.

49. (currently amended) The quantum register of Claim 48, further including ~~at least one~~ a third coupling mechanism coupled between ~~one of the~~ a mesoscopic ~~islands~~ island in said at least one mesoscopic island and the second bank.

50. (previously added) The quantum register of Claim 49, wherein the third coupling mechanism includes a single electron transistor.

51. (previously added) The quantum register of Claim 49, wherein the third coupling mechanism includes a parity key.

52. (previously amended) The structure of claim 1, wherein a qubit is formed by the first bank, the mesoscopic island and the clean Josephson junction, and wherein each quantum state on the qubit is characterized by a clockwise or a counterclockwise supercurrent that circulates in a plane in the vicinity of the clean Josephson junction.

53. (previously amended) The quantum register of claim 8, wherein a plurality of qubits is formed by the plurality of mesoscopic islands, the bank, and the plurality of clean Josephson junctions, and wherein each quantum state on each respective qubit in said plurality of qubits is characterized by a clockwise or a counterclockwise supercurrent that circulates in a plane in the vicinity of the Josephson junction in said respective qubit.

54. (previously amended) The qubit of claim 28, wherein each quantum state on the qubit is characterized by a clockwise or a counterclockwise supercurrent that circulates in a plane in the vicinity of the clean Josephson junction.

55. (previously amended) The quantum register of claim 39, wherein a qubit is formed by each mesoscopic island in the at least one mesoscopic island together with the first bank and a Josephson junction in the at least one Josephson junction, and wherein each quantum state of each said qubit is characterized by a clockwise or a counterclockwise supercurrent that circulates in a plane in the vicinity of the Josephson junction in said qubit.

56. (previously added) The structure of claim 1, wherein a qubit is formed by the first bank, the mesoscopic island and the clean Josephson junction, and wherein the qubit has a quantum state that is twice degenerate in the absence of an external electromagnetic field.

57. (previously added) The quantum register of claim 8, wherein a plurality of qubits is formed by the plurality of mesoscopic islands, the bank, and the plurality of clean Josephson

junctions, and wherein each qubit in said plurality of qubits has a quantum state that is twice degenerate in the absence of an external electromagnetic field.

58. (previously added) The qubit of claim 28, wherein the qubit has a quantum state that is twice degenerate in the absence of an external electromagnetic field.

59. (previously added) The quantum register of claim 39, wherein a qubit is formed by each mesoscopic island in the at least one mesoscopic island together with the first bank and a Josephson junction in the at least one Josephson junction, and wherein each said qubit has a quantum state that is twice degenerate in the absence of an external electromagnetic field.

60. (currently amended) A qubit comprising:

a first bank of a superconducting material having a first crystal orientation;

a mesoscopic island of a superconducting material having a second crystal orientation, wherein at least one of the mesoscopic island ~~islands~~ and the bank comprises a d-wave superconducting material;

a clean Josephson junction between the island and the bank, wherein the Josephson junction is configured so that a supercurrent proximate to the Josephson junction alternates between a first ground state having a first magnetic moment and a second ground state having a second magnetic moment by means of quantum tunneling; and

circuitry to allow selective interruption of quantum tunneling between the first ground state and the second ground state.

61. (previously added) The qubit of claim 60, wherein the circuitry comprises a parity key that connects the island to ground.

62. (previously added) The qubit of claim 60, wherein the circuitry comprises a single electron transistor that connects the island to ground.

63. (previously added) A quantum computer comprising the qubit of claim 60 and a readout device for detecting whether the supercurrent has the first magnetic moment or the second magnetic moment.

64. (currently amended) A quantum register comprising:

a bank of a superconducting material;

a plurality of mesoscopic islands of superconducting material;

a plurality of clean Josephson junctions, wherein each respective Josephson junction:

is between the bank and a corresponding one of the islands; and

is configured so that a supercurrent proximate to ~~each~~ the respective Josephson junction alternates between a first ground state having a first magnetic moment and a second ground state having a second magnetic moment ~~by means of quantum tunneling~~; and

circuitry to allow selective interruption of ~~quantum tunneling~~ the alternating between the first ground state and the second ground state of the supercurrent associated with each Josephson junction, and wherein at least one of the plurality of mesoscopic islands and the bank comprises a d-wave superconducting material.

65. (previously amended) A quantum computer comprising the quantum register of claim 64 and a readout device for detecting whether the supercurrent of each clean Josephson junction has the first magnetic moment or the second magnetic moment.

REMARKS

Claims 1-8, 11-18, 28, 30-39, and 42-65 remain in the application. Independent claims 8, 28, 39, and 64 have been amended so that each claim recites (i) a d-wave superconductor that forms at least one of a bank and a mesoscopic island, (ii) a mesoscopic island, and (iii) a clean Josephson junction formed between a bank and a mesoscopic island. In particular, claim 8 was amended to incorporate the limitations of claims 9 and 10. Correspondingly, claims 9 and 10 were cancelled. Claim 28 was amended to incorporate the limitations of claim 29 and claim 29 was cancelled. Claim 39 was amended to incorporate the limitations of claims 40 and 41. Claim 39 was further amended to recite that at least one *clean* Josephson junction. Correspondingly, claims 40 and 41 were cancelled. Claim 64 was amended to recite that at least one of the bank and the at least one mesoscopic island is made of a d-wave superconductor.

The above-identified amendments were made to expedite resolution of the case and to present rejected claims in better form for consideration on appeal. Upon entry of these amendments, each of the pending independent claims will recite the three above-identified limitations.

A few additional amendments were made in order to present rejected claims in better form for consideration on appeal. Claims 43-45, and 49 were amended for clarity and to correct for antecedent basis.

No new matter has been added by virtue of the amendments to the claims.

Respectfully submitted,
PENNIE & EDMONDS LLP

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By: Gary S. Williams
Gary S. Williams
Reg. No. 31,066

3300 Hillview Avenue
Palo Alto, CA 94304
Telephone: (650) 493-4935